

6.0 Data Collection to Support More Accurate Freight Analysis

■ 6.1 Overview

For some applications, State Departments of Transportation, Metropolitan Planning Organizations and other planning agencies may seek more accurate and reliable estimates of freight activity and may find the quick-response freight planning approaches presented in previous chapters inadequate. For example, the truck trip generation rates recommended in this manual (Table 4.1) which are obtained from Phoenix may not be suitable for a specific site. Estimates of truck traffic volumes and travel times at external stations (see Section 4.3) which are derived from the Truck Inventory and User Survey (TIUS) may be too rough for the desired level of accuracy. Simple growth factor methods presented in Chapter 3 may be inadequate in representing the complex relationships between freight demand and the economic indicator variables in a given area. Agencies always have the alternative to adopt their own procedures to make more accurate estimates. However, this will usually require additional data collection on their part.

As stated in the introduction to the manual (Chapter 1), the methods adopted for the quick-response freight planning approach assume that very little data on freight travel exists within planning agencies, and that they have limited time and resources necessary to develop this information. But what if these agencies are willing to allocate some of their resources to collect more data in order to improve the accuracy of their forecasts? Which data and data collection efforts should they pursue and what costs are involved?

Data collection can be very costly to undertake. In general the time, costs and level of effort required to obtain more accurate and comprehensive freight data depend upon the following factors:

- type and volume of information needed;
- whether the data already exists or still needs to be collected;
- availability of the data, and cost to purchase it (if not free);
- the types of equipment needed to conduct surveys or interviews;
- time needed to perform the data collection in the field or in the office; and
- the level of detail or accuracy desired.

This chapter describes a number of strategies that can be employed by State DOT's, MPO's and other planning agencies to collect better freight information pertaining to various economic indicators, demand characteristics, transportation network, origin-destination flows, and shipper/carrier characteristics -- all of which are needed to support enhanced freight analysis and produce more accurate freight forecasts. To simplify the discussions, the data collection strategies have been classified as either involving *primary* or *secondary* data sources.

Primary data sources include:

1. Survey techniques such as tube counts, classification counts, "postcard" and other roadside surveys, and surveys of freight terminal operators and port authorities,
2. In-depth interviews of shippers and carriers;
3. Establishment of freight advisory committees comprised of key shippers, carriers and other knowledgeable individuals.

While more accurate and desirable, primary data collection activities are both expensive and time-consuming.

Secondary data sources include existing reports, abstracts, or statistics from various public and private agencies at the local, state, and national levels which can be adopted in the freight analysis. These data sources should be explored first especially if the agency has limited resources to conduct the more costly primary data collection techniques. However, more often these data sources either have restricted applicability or are outdated.

■ 6.2 Primary Data Collection

Gathering primary data on freight and traffic flows at the federal, state or local level is a costly and time-consuming process, and data collection programs for most agencies (particularly at the local level) are rarely a funding priority. In addition, the political, technological, and operating changes within the transportation industry have rendered many traditional and often modal-oriented data collection programs inappropriate for intermodal and multimodal planning purposes. While the freight movement and origin-destination data available from federal and commercial sources for rail, water, and air modes are often adequate for planning purposes at the state and local level, comprehensive and detailed information on truck movements is inadequate in most cases. Because the vast majority of all freight movements at some point move by truck, such information is critical to effectively plan and provide the infrastructure and facilities needed for efficient movement and transfer of freight. Accordingly, while the primary data collection methods and procedures discussed below could apply to all modes, there is particular focus on gathering data on truck movements.

6.2.1 Surveys

A critical component of any survey data collection effort is sampling. While there is no definitive way of selecting a sample size, generally the larger the sample, the more reliable the sample estimates. However, it would be impossible and prohibitively expensive to collect data from every transportation carrier, facility, shipper, or location. It is much less expensive to gather data from a sample of the population, which, if drawn accurately, can provide reliable results

In determining the optimal survey sample size, one must consider not only the survey design, but also the logistics of implementing the survey. In the case of roadside/intercept surveys, telephone surveys or personal interviews, this would include factors such as the number of interviewers, length of survey, traffic flow, time frame, location, etc. In the case of mail surveys, this would include reliability of mailing lists and points of contact, method of transmission and return (mail vs. fax or e-mail), etc.

According to the Bureau of Census' *Truck Inventory and Use Study (TIUS)*, about 36 percent of the vehicle miles traveled by trucks occur on trips of less than 50 miles, and an additional 30 percent fall into the category of 50-200 miles. Moreover, 95 percent of all trips are less than 200 miles in length, with 81 percent less than 50 miles. Thus, the majority of all truck trips are local, and most vehicle miles can be considered local. Therefore the sampling strategy for truck surveys should emphasize local travel more than other trip types.

A recent study prepared for the Metropolitan Transportation Commission (MTC) in Oakland, California¹ provides a comprehensive review of what has been and what is being done at the state and local level with regard to truck surveys and truck travel demand forecasting. While the methods and procedures discussed in the report relate to actual truck travel surveys, most can also be applied to other modes of transport. The primary data collection methods and related findings are as follows:

- Telephone interviews generally yield a high response rate and facilitate follow-up; however, the survey must be conducted during normal business hours; the respondent may have limited time, data, or information available at the time of the initial contact and may be unwilling to return calls or accept follow-up calls; and may require mail or fax follow-up to verify data and information recorded by the interviewer. Depending on the sample size, time frame, and nature of the survey, the number and skills of the interviewers may make this method too costly.
- Mailout/mailback surveys are less costly, but generally have a lower response rate. The reliability and completeness of the response may depend on whether the survey form finds its way to the appropriate individual within an

¹ Samuel W. Lau, *Truck Travel Surveys: A Review of the Literature and State of the Art*, prepared for the Metropolitan Transportation Commission, Oakland, California, January 1995. This report includes an extensive bibliography as well as 13 sample forms used in truck surveys throughout the U.S. and Canada.

organization or company. This method also requires some type of tracking so that one can easily identify and follow up with non-responses. The follow-up may be done by telephone/fax, postcard reminders, or re-mail of the survey package.

- Combined telephone-mailout/mailback surveys will generally yield a higher response rate than mailout/mailback; however, it is likely to be more expensive. One variation of this procedure involves contacting a company by telephone to advise that a survey form is being mailed and identify the appropriate department/individual to which the form should be addressed. In this manner, one can often determine whether a company is likely to respond and adjust the sample size accordingly. One can also utilize broadcast fax to distribute survey forms, although the quality of the transmission may affect the response.
- Roadside/intercept interviews are often used for truck surveys and generally yield a high response rate, offer better control over the sample, and enable the interviewer to respond to any questions the respondent may have when completing the form. The disadvantages of this method include potential disruption to traffic flow, safety hazards for the interviewers, less ability to follow up with respondents, the effect of factors such as weather, time of day, lighting etc. on implementation, and restricting the sample to a particular location rather than an entire region.

A paper presented at the 1995 Transportation Research Board (TRB) Meeting² provides a comprehensive outline for gathering truck movement data and information on a statewide basis. The paper describes the methodology and procedures employed to interview a total of 30,000 truck drivers at 28 weigh stations located throughout the State of Washington. The interviews were conducted in each of four seasons to take into account seasonal differences in truck movements. The researchers established a goal of conducting 300 surveys over a 24-hour period at each survey site, and ultimately interviewed approximately 7500 drivers during each of the survey periods. The following summarize the significant aspects of the methodology and procedures:

- The survey gathered information on vehicle configuration, origin and destination, highway route, cargo type, vehicle and cargo weight, and the use of intermodal facilities. Identification of routes was accomplished with the aid of a map attached to each questionnaire. The primary data collection sites included permanent weigh stations, ports of entry, and border crossings along major interstate and state highway corridors. The questionnaire was designed so that it could be completed within three minutes, with about half the questions answered by the interviewer through direct observation of the vehicle. Terms (such as “payload weight”) that were not readily understood by truck drivers were identified during a pretest and replaced by simpler language (e.g., “the weight of the cargo being carried”).

² William R. Gillis, Kenneth L. Casavant, and Charles Howard, Jr., *Survey Methodology for Collecting Freight Truck Origin and Destination Data*, presented at the TRB Annual Meeting, Washington, D.C. January 1995.

- Interview teams, totaling up to 90 people on any given day, were recruited from community service clubs, comprised of individuals with personal knowledge of local roads, industries, and transportation facilities. They were trained, supervised, and periodically evaluated by members of the project management team. Training included instruction in personal interviewing techniques, how to accurately identify different truck and trailer configurations, and safety procedures and requirements. Each team was provided with equipment ranging from clipboards and pens to reflective safety vests, headlamps, and hats. Each site was equipped with a survey crew sign and traffic cones. Cooperation and assistance was provided by uniformed Commercial Vehicle Enforcement Officers and Customs officials, helping to ensure the safety of the interviewers and, by directing selected trucks to the interview site, creating an atmosphere that produced a high response rate. Trucks were selected, on the basis of the sequence in which they were weighed, at a rate that made it possible for the interview to begin without delay.
- At each site, a member of the project management team was available to check completed questionnaires for accuracy and to address any problem areas with interview personnel. Weather and other unforeseen events also had an effect on the quality of data gathered, with some interviews conducted inside the scale house during particularly inclement weather. In addition, during high-volume traffic periods, there were occasions when enforcement and interviewing activities had to be suspended to enable traffic to clear. There were a few instances where interview activities were suspended for a period of time as a result of nearby construction activity or, in one case, a hazardous material spill.

The data collection effort was highly successful, with a 95% response rate providing data and information for an extensive database of statewide freight and goods movement in Washington. It should serve as a good example of how surveys can be made in an efficient manner. The costs, however, are a different issue.

The following describes how three survey procedures, namely: truck counts at external stations, truck surveys at external stations, and commercial vehicle origin-destination surveys can enhance freight analysis.

Truck Counts at External Stations

The planning agency may need to perform new counts for major external stations with old, suspect, or missing data, or as part of a comprehensive data collection effort. Truck counts at external stations also involve classifying commercial vehicles for calibrating and validating trip distribution forecasts. Cordon or screenline counts are recommended for most situations. Tube counts, electronic sensors, weigh stations, toll or turnpike counts, or video or visual classification counts may be used. Once data is available for a broad representation of facility and highway types, the state or regional planning agency may expand the data to similar highways that were not sampled.

Traffic volumes at external stations, as well as the types of trips involved (i.e. external-external, internal-external and external-internal) vary significantly with location. For

example, a 1991 study of nine counties in the San Francisco Bay Area³ found that 98% of all trucks surveyed involved local or intra-regional trips; that is, they either had their origin or destination in one of the nine counties, which means that only 2% are “through” trips. On the other hand, a 1990 study in Yuma, Arizona⁴ found that 7% of all trips (passenger and freight) were through trips. Still a 1994 origin-destination interview survey conducted on the perimeter of Berks County, Pennsylvania⁵ determined that 27% of the trucks entering or leaving the county were not stopping within the county, and were thus through trips. These wide variations indicate that data collection and analysis of actual truck traffic patterns, particularly at external stations, can produce more reliable freight forecasts than those that represent national averages such as recommended in the quick response method (see Section 4.3 - External Stations, in Chapter 4).

In conducting the truck counts, however, one must bear in mind that research suggests wide variances in truck counts or classifications based on tube counts due to equipment calibration, vehicle speed and traffic density. Therefore caution should be exercised in applying tube counts for vehicle classification in the freight trip generation and distribution models.

Truck Surveys at External Stations

Truck surveys at external stations are typically accomplished through interviews conducted at external stations to identify internal-external, external-internal, and external-external patterns of travel. These surveys provide the basis for trip generation, trip distribution and time-of-day analyses discussed in Chapter 4, and are usually performed simultaneously with truck counts.

The state or regional planning agency may face situations in which “through” freight traffic, or traffic generated from non-local, widely dispersed sources, contributes significant traffic volumes to the area. In this situation, the agency may decide to conduct vehicle classification surveys and roadside/intercept origin-destination surveys at major external stations to estimate external-external, external-internal, and internal-external trips. Roadside interviews are most easily performed at weigh stations, although toll plazas, border crossing stations and roadside pull-offs have also been used.

A summary of the advantages and disadvantages of truck interview surveys, taken from the MTC Report described above, is shown in Table 6.1.

³ Schlappi, Marshall, and Itamura. *Truck Travel in the San Francisco Bay Area*. TRB 72nd Annual Meeting, Paper No. 930477. January 1993.

⁴ Yuma Metropolitan Planning Organization. *1990 Origin-Destination Survey*. 1990.

⁵ Matherly, D. “Stream of Traffic Interview” *Truck Survey: Methodology and Recommendations on Traffic Volume Thresholds*. Paper presented at the 75th Annual Meeting of the Transportation Research Board. Paper 960581. November 1995.

A method that might serve State or regional planning agencies with a single "target route" for through trip activity would follow a particular survey strategy implemented in Des Moines, Iowa. This method involved a roadside truck survey at two major interchanges along a route, without stopping the vehicles, by verbally recording the time, the tractor color and/or name, company name on the side of the cab, and any remarks. The purpose of the survey was to identify through truck trips, defined as trucks that had an elapsed time of 11 to 19 minutes between observation points.

If Automated Vehicle Identification (AVI) information is available, it can also be very helpful in determining vehicle routing, weight and time-of-day information.

Table 6.1 Advantages and Disadvantages of Truck Interview Surveys

Advantages	Disadvantages
Complete information	Potential disruption to traffic
High response rate	Quality and conduct of survey affected by weather, lighting
Better sampling control	Hazardous to survey crew
Good representative sample of trucks entering or leaving a cordon line	Time constraint; no follow-up possible
Easy comparison with mainstream traffic through field counts at survey location	Enforcement problems at the station; drivers avoiding the survey station
	Only represents trucks traveling on road along survey stations, not entire region

Commercial Vehicle Origin-Destination Surveys

Commercial vehicle origin and destination surveys are usually accomplished through phone and mail surveys with trip logs, and are based on registered vehicles. These surveys tend to focus on internal-internal movements with internal-external and external-internal movements for locally registered vehicles. The results of commercial vehicle origin and destination surveys are used in freight analysis to provide a basis for analyzing trip generation, trip lengths (for distribution) and time-of-day characteristics.

The quick response methodology described in Chapter 4 develops trip generation rates from local land use patterns, primarily using national default values applied to local patterns. A planning agency may determine that a higher level of accuracy is required to reflect unique circumstances in its own region.

Mail and phone surveys are less geographically restricted than roadside/intercept surveys in terms of survey sites but tend to capture primarily local trips. They usually provide more detail than an intercept interview, and generally have lower response rates than an actual interview.

A key element in conducting a successful freight origin-destination survey is identifying relevant shippers, carriers and receivers, and obtaining the cooperation and participation of local and regional freight representatives. Many mail and telephone surveys establish the "universe" through state vehicle registration files. This may capture most strictly local firms, but many local shipping firms will be part of a national conglomerate that may register vehicles almost anywhere. Appendix K identifies national public sources that may assist in devising a complete sampling frame. Alternatively, the state or regional planning agency may wish to purchase specific data from a commercial data source, such as those described in Appendix L.

6.2.2 In-depth Interviews with Shippers and Carriers

Lengthy personal interviews are the most costly method of conducting surveys and generally involve a smaller, more select or targeted sample. This approach is particularly appropriate when assessing the feasibility of new or expanded facilities (see Chapter 5 - Site Analysis). Interviews with shippers to ascertain the demand for such facilities and interviews with carriers to determine whether they would consider providing/expanding service to/from the facility are critical to the freight planning and decision-making process. These types of interviews are particularly useful for analyzing special trip generators including intermodal transfer facilities and warehouses.

6.2.3 Establishment of Freight Advisory Committees

A Freight Council provides regular contact with local representatives of the freight industry. Such contacts are invaluable for identifying freight issues and opportunities and, more importantly, data. The advantage of establishing freight advisory committees such as the Freight Council is that members may be more willing to share information. Such a council will also assist the planning agency in reviewing the local road network from the freight perspective, based on the needs assessment, as well as in identifying capacity, classification and condition. For example, eight national associations representing all freight transportation modes and the nation's manufacturers and shippers have created the *Freight Stakeholders National Network*. This network is designed to promote private-public coalitions, and can help establish an effective freight council through recruiting participants from the freight sector.⁶

The data collection and analysis activities required for freight planning/modeling which are shared among freight industry representatives may also contribute to greater understanding between planning agencies and the private sector freight community.

⁶ For more information, contact Rebecca Myer, American Trucking Association, (404) 873-1201.

Table 6.2 identifies typical concerns of freight carriers (see Appendix A for a glossary of the freight terminology). An agency that demonstrates a preliminary understanding of freight handlers' concerns will be more likely to obtain cooperation in gathering data of importance to the public agency. In addition, a cooperative effort, such as designing a survey that meets the needs of the freight community as well as the planning agency, will likely have a much higher response rate.

■ 6.3 Secondary Data Collection

A recent survey on data sources used for freight analysis revealed that States, MPO's and port/airport authorities utilize and, in large part, rely on secondary data and information which are compiled and published by federal agencies and/or private and commercial sources for data related to freight movement and freight transportation.⁷ The principal state-level transportation databases are primarily truck-related and include vehicle registration, operating authority, fuel and other taxes, and safety. Data on commodity movements and origins/destinations are limited as to the level of detail required or desired for forecasting and planning purposes. Of those agencies which do collect primary data as described in the previous section, most do so sporadically or infrequently.

More detailed data pertaining to the volume and type of freight movements may be helpful for fine-tuning estimation model results, for ensuring complete coverage of the region, and in some cases for estimating external-external (through) trip flows. Commodity data are also helpful in accurately forecasting future freight flows and activity levels. The U.S. Bureau of Economic Analysis (BEA) produces forecasts of employment and earnings by industry for states, counties, metropolitan statistical areas, and BEA Economic Areas. An accurate baseline with disaggregate commodity detail can take full advantage of this national forecasting resource.

A planning agency can usually identify the major shippers, carriers, and receivers in the region without conducting a primary data collection survey. It may already have significant information. Thus, the search for more detailed freight data should generally begin at the agency level, expand to local sources, and fill in remaining gaps with state and national sources. Alternatively, the state or regional planning agency may wish to purchase specific data from a commercial data source. Commercial sources may have available, for purchase, enough detailed data to eliminate the need for a full survey, or may be able to supply the data to make a survey more effective. Commercial sources are listed in Appendix L.

⁷ NCHRP 8-30 Report - *Forecasting Freight Transportation Demand. A Guidebook for Planners and Policy Analysts*. Cambridge Systematics Inc., January 1996.

Table 6.2 - Freight Planning Issues for State DOT's and MPO's⁸

Physical Limitations : Delivery and Collection

- Structural vertical clearance for doublestacking & railroad electrification
- Peak and off-peak delivery of freight
- Structural vertical clearance for truck movements
- Freight delivery at major centers of activity
- Horizontal radii limiting truck movement highway access to intermodal facilities
- Structural integrity and remaining pavement life
- Bridge or road weight restrictions
- Land-side access to airports and harbors
- Road access to rail terminals
- Loading facilities- intermodal, single mode
- Parking restrictions for freight deliveries
- Downtown congestion
- Truck delivery and loading interference with street traffic

Accessibility and Safety

- Accessibility time and cost to intermodal facilities
- Designated truck routes
- Highway-Railroad crossing safety
- Hazardous materials shipment

Transferability and Coordination: Legal and Regulatory

- Movement interference between modes at highway- railroad crossings
- Movement interference between modes at highway-waterway crossings
- State multimodal trust funds & funds eligibility
- Congestion and delays created by drayage
- Truck weight limitations
- Liability of freight rail lines for transit usage
- Highway-ferry boat transfer delays

Economics and Environmental

- Economics tradeoffs between modes and combinations of modes
 - Air, noise, and wetland impacts of intermodal facilities
 - User fees and subsidization of transportation modes
 - Economic impact of railroad abandonment roads
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⁸ Adapted and expanded from an assessment of issues originally developed by Dane Ismart of Federal Highway Administration and published in Meyer, Michael; *Rail, Intermodalism and ISTEA, Symposia on Partnerships with Railroads*, June 1994.

Depending upon the size and location of the State or metropolitan/local area within a National Transportation Region (NTAR), other secondary data sources briefly described in Chapter 4 and/or contained in the Appendix may provide enough information to avoid a major primary data collection effort. There are 89 NTAR's in the country, comprised of 179 Bureau of Economic Analysis (BEA) regions. Certain flow data, such as the *Commodity Flow Survey*, are available by commodity type at the NTAR to NTAR region, and may thus provide more reliable information pertaining to "through" trips for large regional or state studies (see Appendix K).

FHWA is also a major source of freight data, and is currently publishing an update of the Travel Survey Manual (last released in 1987). The manual will include sections on freight and truck surveys. It will be available through FHWA. A CD-ROM version may be distributed through the Bureau of Transportation Statistics (BTS).

Appendix M describes additional truck and freight surveys conducted by metropolitan planning organizations throughout the country, plus others in the planning stages. Contact names are provided for further information.

The following describes other additional secondary data sources at the local, state, regional and national levels which can be used to obtain more accurate data for freight analysis.

Other Local Sources

The local chamber of commerce typically has listings of the major employers in the region, usually including information on key products, annual sales volume, floor space, and number of employees. This may or may not include the number of trucks, loading docks, etc. If so, trip generators can be readily mapped into the appropriate zones.

The local tax assessment office will have similar information, possibly more current and accurate but local laws on confidentiality may restrict access.

The local phone book (business-to-business directory or commercial directory) may help identify key employers who do not belong to the chamber of commerce. Local Yellow Pages and business-to-business directories can also assist in building linkages between a terminal or warehouse and retail outlets, such as grocery stores. Electronic business address files for the entire country are also available on CD-ROM.

Other State Sources

Appendix H lists the trucking association for each State. These associations are an excellent source of information about the trucking industry, and is the natural conduit for sharing information within the industry. A list of trucking members in the State will not provide 100 percent coverage of truck related organizations, but should provide a major starting place. Types of firms that may not typically belong to the state trucking associations include many single, owner-operated trucks, service firms (office equipment

repair, etc.), construction firms, extraction firms (gravel, mining), and government-related firms such as municipal waste disposal, postal service, military goods movement, etc.

Other National Sources

Appendix J lists a sampling of national trade associations concerned with freight movement. Brief descriptions of each association or reference source are included. More complete listings of associations and databases are available from the following:

- *TruckSource*, published by the American Trucking Association (ATA) and updated each year, also includes directories, contacts, etc. The ATA can be contacted at: *American Trucking Associations, Customer Service, 2200 Mill Road, Alexandria, VA 22314-4677*.
- *The Encyclopedia of Associations*, by Gale Research Co., is the most comprehensive list of associations and is available at most public libraries.

A planning agency should generally contact those associations or reference sources for which local sources are incomplete. For example, the state or regional planning agency may know of a large truck garden industry in the county, with widely dispersed owners, and does not know how or where these goods are typically transported. A call to the *United Fresh Fruit and Vegetable Association*, listed in Appendix J, would identify major local shippers of that commodity, locations of refrigerated terminals for consolidating and breaking up shipments, and possibly typical transport patterns.

National sources will also be the best for locating non-truck intermodal data, including inland or Great Lakes or ocean waterways, air cargo, rail cargo, and pipeline movement of goods. The specialized database section (Appendix K) includes data sources for pipelines, coal movements, military transportation, Mexican and Canadian trade, imports and exports, and other topics. State or regional planning agencies with even more specialized needs may refer to the *Directory of Transportation Data Sources*, *TruckSource*, or commercial sources.